Australian Outback Systems

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Grids & Energy Efficient Systems
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ENERGY FLAGSHIP
www.csiro.au

CSIRO

CSIRO

Commonwealth **S**cientific and **I**ndustrial **R**esearch **O**rganisation

CSIRO is Australia's national science organisation and largest scientific enterprise

CSIRO has over 5,000 staff located across 56 sites throughout Australia and overseas

CSIRO total revenue is around $1 billion annually and comes from the Federal Government and external sources

CSIRO Energy Centre

Provides a focal point in Australia for energy research

The building showcases the work of Energy Technology and demonstrates:

- sustainable energy generation initiatives
- practical examples of building energy demand reduction
- environmentally conscious, realistic energy supply options.

Home to National Solar Energy Centre (NSEC) which houses a 500kW heliostat array

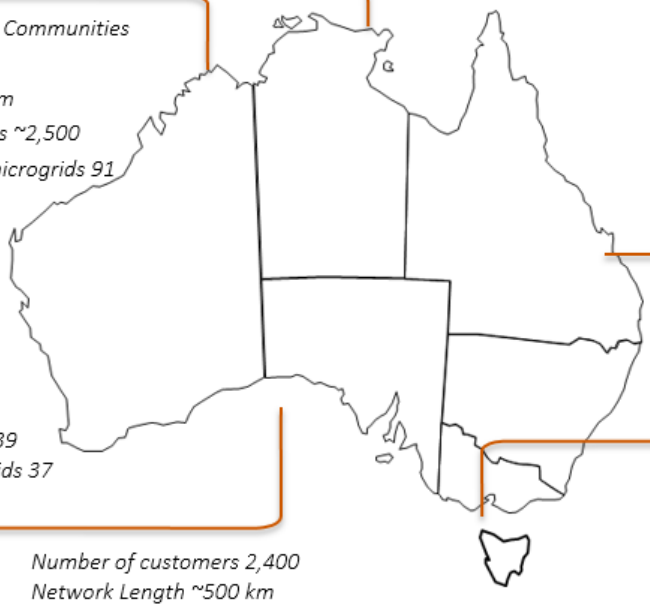
Has substantial on-site generation

- microturbines
- wind turbines
- photovoltaics
- energy storage

Based in Newcastle, Australia

Newcastle - Where is that?

Australian Microgrids



WA

Water

- *Total Assets $450m*
- *Mains Length 2,150 km*
- *Number of customers 30,039*
- *Number of remote microgrids 37*
- *Water Produced 21,544 ML*

Larger Remote Aboriginal Communities

- *Total Assets $770m*
- *Mains Length ~325km*
- *Number of customers ~2,500*
- *Number of remote microgrids 91*

Other

- *Standalone water schemes ~100*
- *Other Small community systems > 150 (<50 population)*

Horizon Power Microgrids

- *Total Assets $1,200m*
- *Network Length 6,300 km*
- *Number of customers 30,039*
- *Number of remote microgrids 37*

SA

- *Remote Power systems 13*
- *Remote Aboriginal communities 16*
- *Number of customers 2,400*
- *Network Length ~500 km*

NT

- *Total Assets $830m*
- *Network Length 3,000 km*
- *Mains Length 1,164 km*
- *Number of Customers ~25,000*
- *Remote Power Networks ~13*
- *Remote Water Networks ~18*
- *IES Community Systems (power and water) 72*

QLD

- *Total Assets $2702[3]*
- *Remote Power Networks 33*
- *Large number of standalone municipal water Schemes*
- *Number of Customers ~7,500[2]*

TAS

- *Total Assets ~$25m[4]*
- *Network Length ~727 km*
- *Remote Power Networks 2*
- *Number of customers ~2,000*


Renewable energy buyback
Prices and available hosting capacity
Effective 1 August 2016
You can reduce your electricity bill by generating some of your own electricity. If you do not use all the electricity you generate, you may be able to export this into our electricity system by participating in our renewable energy buyback offer.
The table opposite shows the buyback price in your town and the total kilowatts of renewable energy we are able to accept (the hosting capacity).
Unmanaged hosting capacity is generally available to non-business customers who wish to install a five kilowatt or less renewable energy system. We are able to offer additional hosting capacity if generation managed systems are installed (this is the managed hosting capacity). Generation management stores and/or controls the electricity output of the renewable energy system but may be more expensive to install.
We recommend you use the eligibility calculator on our website to determine whether you are eligible to participate in our renewable energy buyback offer and whether you need to install a generation managed system.
* Prices quoted are rounded to two decimal places and are exclusive of GST.
** Includes Port Hedland, Roebourne and Karratha
Town
Renewable energy buyback offer* (cents/kWh)
Unmanaged hosting capacity (kW)
Managed hosting capacity (kW)
Ardyaloon 42.71 0 202
Beagle Bay 44.64 20 242
Bidyadanga 34.11 32 389
Broome 7.14 0 0
Cambalin/Looma 29.11 0 269
Carnarvon 10.56 23 1001
Coral Bay 19.73 0 191
Cue 26.75 103 431
Denham 27.93 0 0
Derby 7.14 20 740
Djarindjin 46.30 0 242
Esperance 10.29 0 1 389
Exmouth 7.14 182 0
Fitzroy Crossing 7.19 0 1123
Gascoyne Junction 46.59 182 77
Halls Creek 7.65 0 1009
Hopetoun 34.30 40 229
Kalumburu 50.55 0 476
Kununurra/Wyndham/Lake Argyle 10.33 0 6122
Laverton 32.82 0 455
Leonora 14.18 0 0
Marble Bar 48.05 86 0
Meekatharra 26.42 0 1433
Menzies 51.42 0 967
Mount Magnet 21.20 10 1905
Norseman 28.33 0 0
Nullagine 41.86 5889 5446
NWIS** 7.68 243 1655
Onslow 18.79 0 321
Sandstone 27.64 32 389
Warmun 39.76 15 78
Wiluna 28.41 0 164
Yalgoo 28.76 32 381
Yungngora 39.47
www.horizonpower.com.au
HORIZON POWER
energy for life
GUSS – Grid Utility Support System
First deployment – 20 units
25kVA single phase, 100kWh
12 different locations
New and challenging for industry
Environmental specifications
Power quality specifications
Data and control specifications
(Intelligent Electronic Device)
Smart control
HORIZON POWER
Technical Requirements for Renewable Energy Systems Connected to the Low Voltage (LV) Network via Inverters
Specification Number: HPC-9FJ-12-0001-2012
POWER AND WATER CORPORATION
SOLAR/DIESEL MINI-GRID HANDBOOK
PowerWater

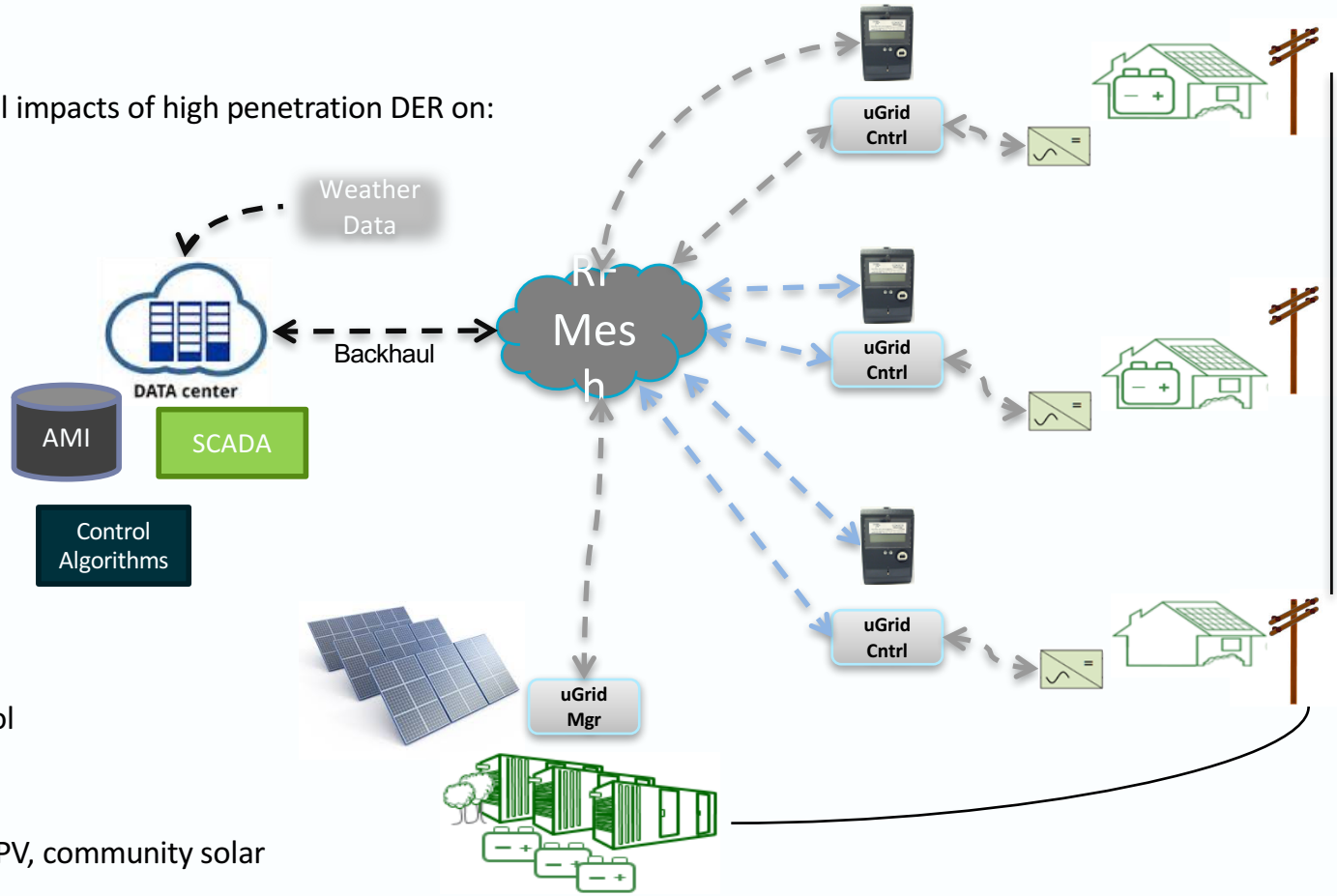
CSIRO

Microgrid Operating Platform Development: Carnarvon Trials

Maximising Renewable Energy Penetration through visibility and control

What are the technical and commercial impacts of high penetration DER on:

- Safety, Network Protection
- Power Quality
- Operational Practices
- Technical Standards
- Business Model



The Trials:

1. Solar PV monitor and control
2. Energy Storage monitor and control
3. Micro grid control
4. Centralised battery, decentralised PV, community solar

Plug and Play Solar Project

- Plug and Play Solar – A three-year project implementing CSIRO operation, planning and renewable grid integration optimisation techniques in order to increase grid flexibility and intelligence
- Continues and consolidates findings from the CSIRO Report *Solar Intermittency – Australia's Clean Energy Challenge* (2012)
- Immediate focus on isolated "town size" grids – specifically supporting solar displacement of diesel in remote area power systems
- Partners: NREL, ABB Australia, CSIRO and ARENA

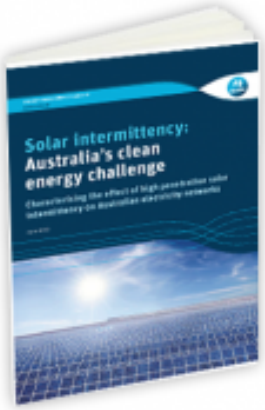
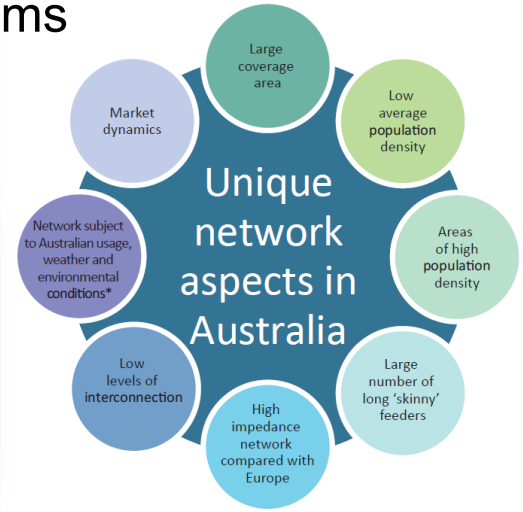


Table 2 Potential power system impacts of intermittency over various intermittency timescales

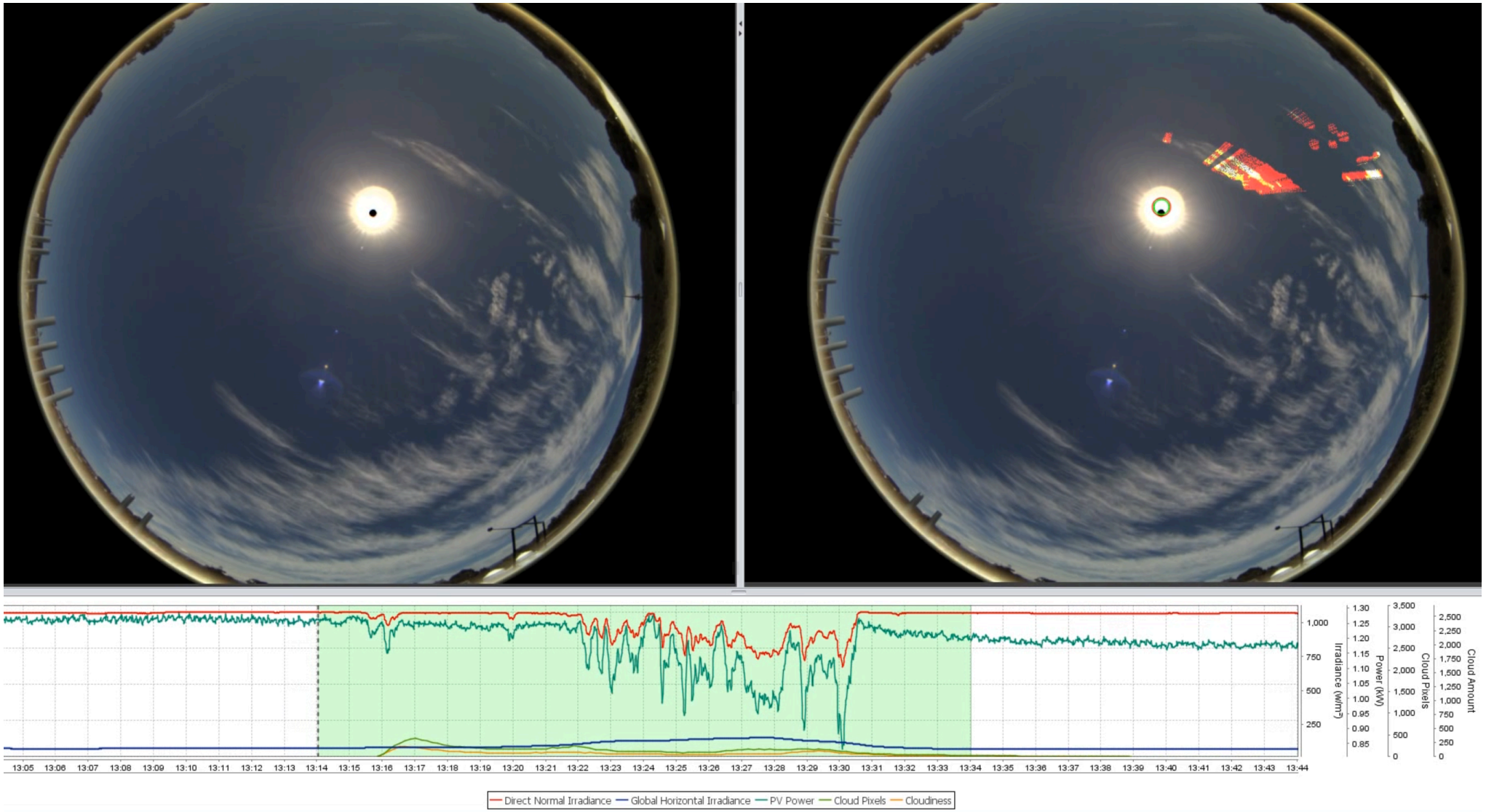
Timescale of Intermittency	Potential Power System Impact
Seconds	Power quality (e.g. voltage flicker)
Minutes	Regulation reserves
Minutes to hours	Load following
Hours to days	Unit commitment



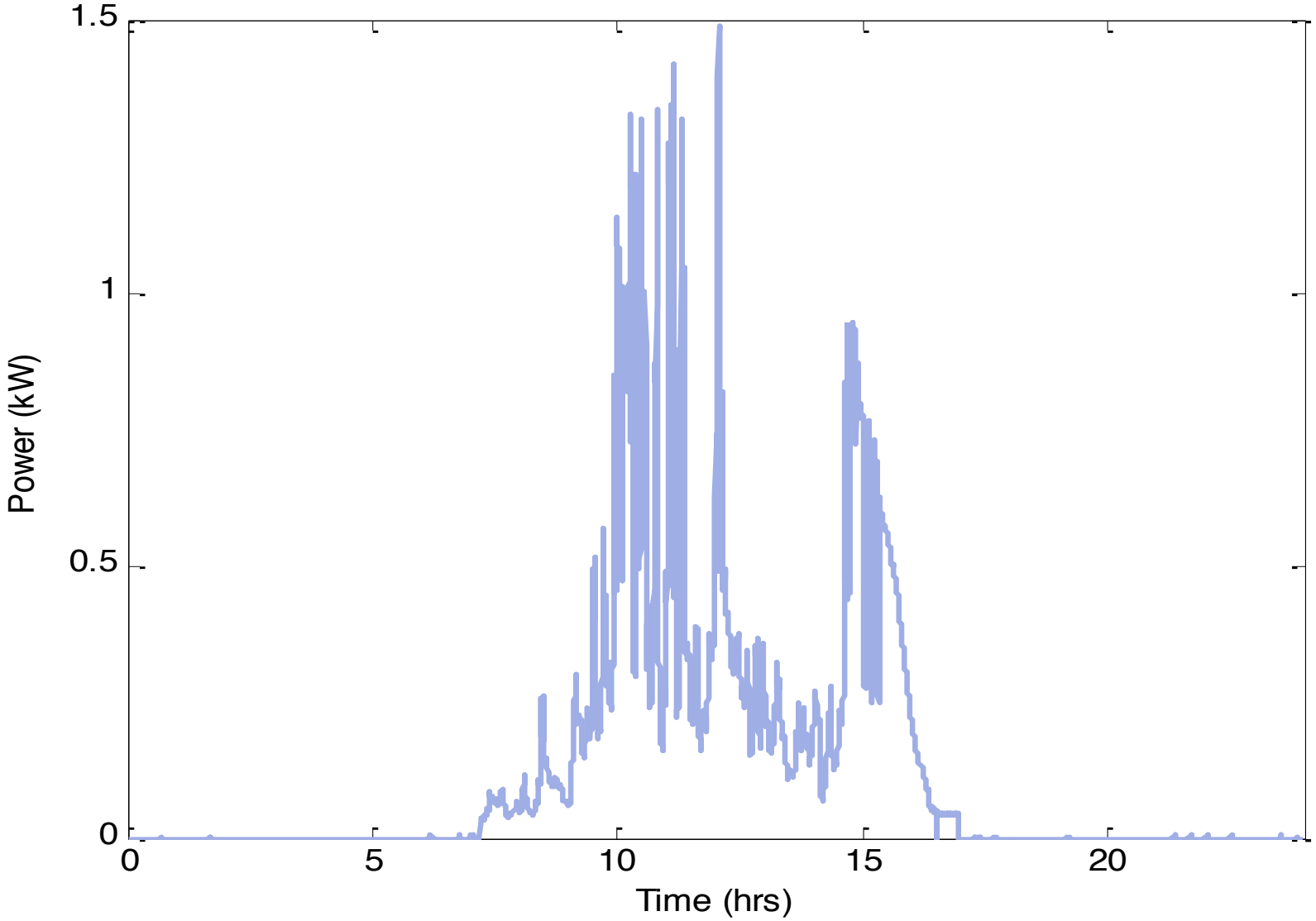
*Australian load profiles and environmental conditions such as fire and flood

http://www.csiro.au/science/Solar-Intermittency-Report

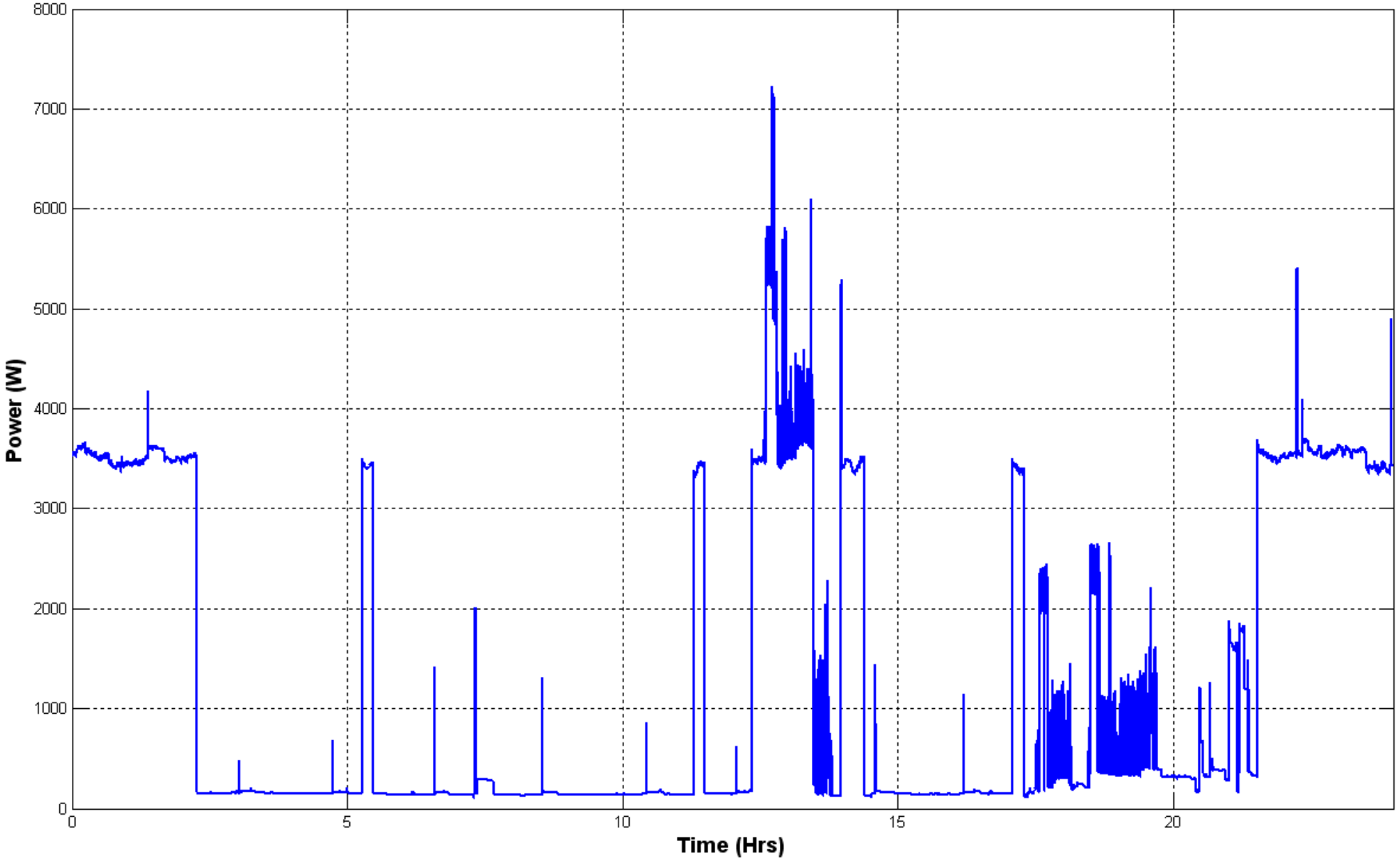
Integrating Solar Forecasts



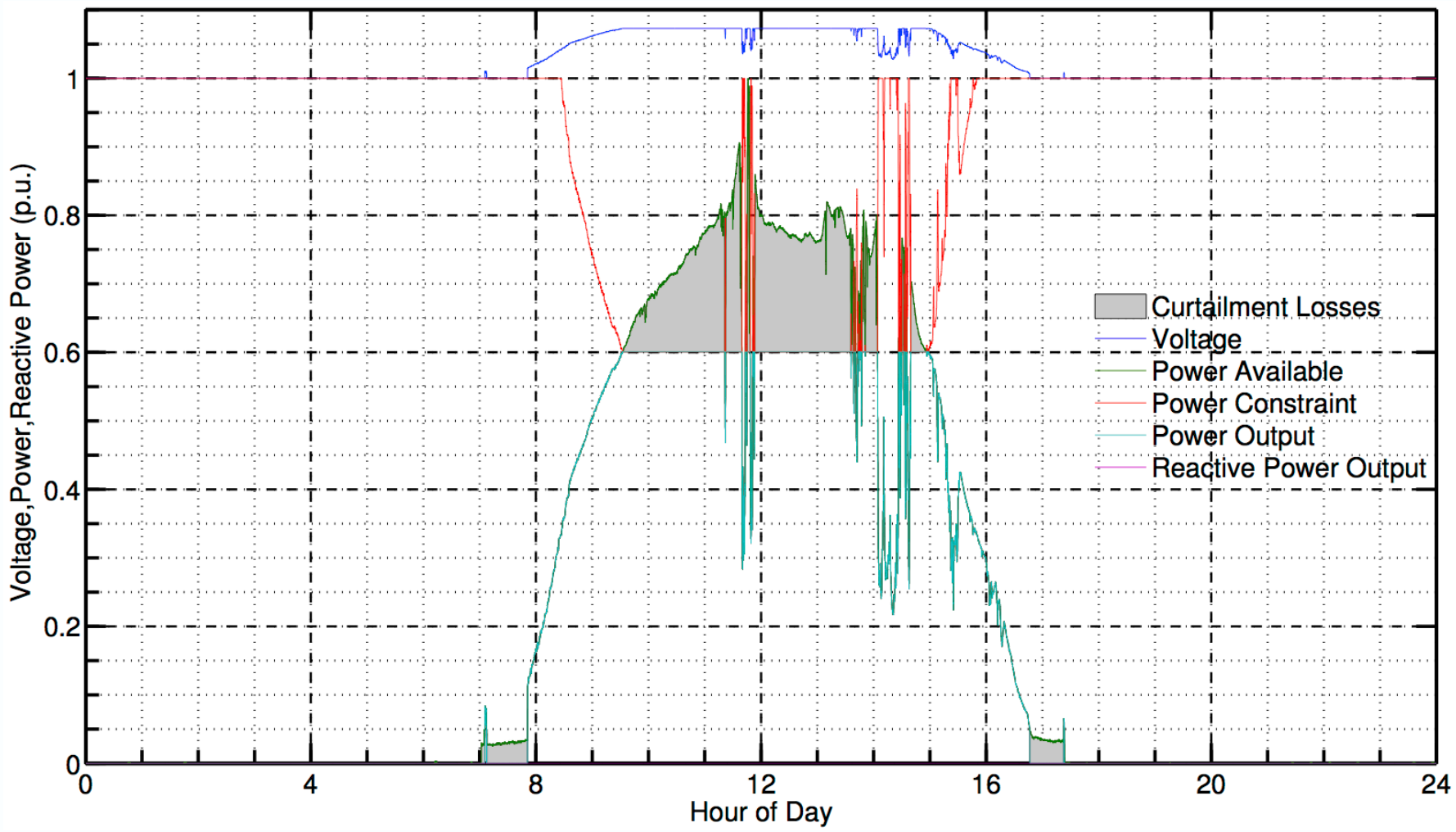
Solar intermittency



Load intermittency



Power Quality management



Evolving Standards - Demand Response

Mode	Requirement
DRM 0	Operate the disconnect device
DRM 1	Do not consume power
DRM 2	Do not consume more than 50% of rated power
DRM 3	Source VARs AND do not consume more than 75% of rated power
DRM 4	Increase power consumption (subject to other constraints)
DRM 5	Do not generate power
DRM 6	Do not generate more than 50% of rated power
DRM 7	Sink VARs AND do not generate more than 75% of rated power
DRM 8	Increase power generation (subject to other constraints)

Thank you

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